

ST1 Progress on Evaluation and Improvement of Recreational Fishery Survey Methods

The following issues have been under investigation by the NOAA Fisheries Office of Science and Technology, Fisheries Statistics Division (ST1) staff within the past year. We have been focused on evaluating possible causes of bias in current surveys, as well as potential methodological enhancements that could be used to improve current or future surveys. The issues we have addressed have been identified as potentially important by NRC, the Management Frame Workshop and/or ST1.

MRFSS and For-Hire Survey (FHS) Intercept Surveys:

1. **Potential Bias Due to Estimation Error:** Because site-day sample selection probabilities are not used in estimation equations, both point and variance estimates of catch per angler trip may be biased.
 - 1.1. **Background:** The sampling for the on-site intercept surveys is initially based on a probability sample of site-day units listed in a matrix frame of fishing access sites and days. Selection probabilities for different site-day units in the site x day sampling frame are assigned in relation to expected amount of active anglers to be encountered. The probability sampling of site-day units is intended to assure representative sampling of angler trips among the site-day units included in the frame. Site-day units with more angler fishing trips should have a higher probability of inclusion than site-day units with fewer trips. If only one angler trip was intercepted in each selected site-day sample unit and the selection probabilities of site-day units accurately reflected the proportions of total angler trips encountered within those units, the resulting sample of angler trips should be representative and no weighting of data would be needed. However, for obvious economic reasons the sampling protocols encourage intercepts of up to 20 (or 30 in some cases) angler trips per selected site-day unit. This could result in an over-representation of angler trips occurring within site-days with higher fishing activity. A bias would result if mean angler catch rates differed significantly between high and low activity site-day units.
 - 1.2. **Assessment:** The current method for estimating mean catch per angler trip from the intercept survey data does not take the site-day sample selection probabilities into account. The NRC review suggested that the selection probabilities could be used as weighting factors in the estimation equations to appropriately correct for any biases that may be caused by a consistent over-representation of angler trips within high (or low) activity site-day units. The site-day sampling frames and selection probabilities assigned to different site-day units have been maintained in separate data files for each two-month wave of sampling since the early 1990's.
 - 1.3. **Completed Actions:** The sampling frames used for the collection of historical intercept survey data have been retrieved and matched with "sample draw" databases containing the actual site-day units selected for sampling. Alternative

equations that incorporate the appropriate probability sampling weighting factors are being evaluated.

- 1.4. **Recommended Actions:** The site-day selection probabilities should be extracted and merged into the intercept survey data files so that they can be used to appropriately weight sampled angler trip data in the estimation process. Estimation equations should be developed that perform the necessary differential weighting of data. Estimates should be generated with the new equations and compared to those generated with the current equations to assess the magnitude and direction of any apparent biases in the current approach.

2. **Potential Bias Due to Estimation Error:** Because the multi-stage cluster sampling design has not been taken into account in estimation equations, both point and variance estimates of catch per angler trip may be biased.

- 2.1. **Background:** The Intercept Surveys use a multi-stage cluster sampling design that is not currently taken into account in the estimation equations. Once a given site-day unit in the site x day sampling frame has been selected, it is assigned to an intercept survey interviewer. The interviewer is instructed to survey the site on the assigned day by intercepting and interviewing anglers who have completed fishing in the appropriate mode. Since it is not always possible to intercept and interview every eligible angler that the interviewer observes at the site, a systematic subsample of angler trips is obtained for complete interviews. Within the cluster of angler trips encountered and subsampled at the site, there may also be clusters of anglers who fished together on the same boat. Such clusters of angler trips within the site-day clusters are also frequently subsampled. The sample of angler trips obtained from the sampling of site-day frame units is treated like a simple random sample of angler trips in the equations used to estimate mean catch per angler trip.

- 2.2. **Assessment:** In order to properly take the two-stage cluster sampling of angler trips within each site-day into account in the estimation equations, one must know the actual sizes of the respective clusters, as well as the site-day and vessel cluster memberships of each sampled angler trip. Data on cluster sizes and cluster membership have been collected by the intercept surveys since the early 1990s. These data can be used to develop appropriate estimation equations that could correct for any possible biases in point estimates, or variance estimates, that could result from assuming that a simple random sample of angler trips was obtained.

- 2.3. **Completed Actions:** The data on cluster sizes and membership have been merged with angler trip data so that the cluster sampling design can be taken into account when the data are used for estimation of mean catch per angler trip. Alternative equations to incorporate the effects of the cluster sampling design are being evaluated.

- 2.4. **Recommended Actions:** Data on the numbers of “eligible” angler trips missed in each sampled site-day cluster of trips should be used in combination with data on the numbers of intercepted eligible trips to determine the total number of trips encountered in each sampled site-day unit. Data on the number of angler trips that occurred on the same boat with an intercepted trip should be

used to determine the size of each subsampled boat cluster of trips within a given site-day cluster. Estimation equations should be developed that incorporate the cluster sampling design, including the subsampling of clusters at different levels. Estimates should be generated with the new equations and compared to those generated with the current equations to assess the magnitude and direction of any apparent biases in the current approach.

3. **Potential Bias Due to Estimation Error:** Because the multi-stage cluster sampling design has not been taken into account in estimation equations, both point and variance estimates of mean weight of catch may be biased.
 - 3.1. **Background:** The Intercept Surveys use a multi-stage cluster sampling design for obtaining measurements on landed fish that is not currently taken into account in the estimation equations used for mean weight estimates or estimates of length frequency distributions. The samples of landed fish of each species that are measured for length and weight data are not simple random samples. They are actually samples obtained by the subsampling of site-day clusters of vessels, the subsampling of vessel clusters of anglers, and the subsampling of clusters of fish landed by different interviewed anglers. Each interviewed angler potentially provides a cluster of landed fish for measurements. Since it is not always possible to obtain measurements on all fish landed by a given interviewed angler, a systematic subsample of fish is selected for measurements. The sample of fish measurements obtained from the multi-stage cluster sampling design is treated like a simple random sample of landed fish in the equations used to estimate either the mean weight or length distributions of landed fish.
 - 3.2. **Assessment:** In order to properly take the three-stage cluster sampling of landed fish within each site-day into account in the estimation equations, one must know the actual sizes of the respective clusters, as well as the site-day, vessel cluster, and angler cluster memberships of each measured fish. Data on cluster sizes and cluster membership have been collected by the intercept surveys since the early 1990s. These data can be used to develop appropriate estimation equations that could correct for any possible biases in point estimates, or variance estimates, that could result from assuming that a simple random sample of landed fish was obtained.
 - 3.3. **Actions Taken:** The data on cluster sizes and membership have been merged with angler trip and fish measurement data so that the cluster sampling design can be taken into account when the data are used for estimation of mean weights of landed fish. Alternative equations to incorporate the effects of the cluster sampling design are being evaluated.
 - 3.4. **Recommended Actions:** Data on the numbers of “eligible” angler trips missed in each sampled site-day cluster of trips should be used in combination with data on the numbers of intercepted eligible trips to determine the total number of trips encountered in each sampled site-day unit. Data on the number of angler trips that occurred on the same boat with an intercepted trip should be used to determine the size of each subsampled boat cluster of trips within a given site-day cluster. Data on the number of fish that were landed by each

angler should be used to determine the size of each subsampled angler cluster of landed fish. Estimation equations should be developed that incorporate the cluster sampling design, including the subsampling of clusters at different levels. Estimates should be generated with the new equations and compared to those generated with the current equations to assess the magnitude and direction of any apparent biases in the current approach.

4. **Potential Bias Due to Estimation Error:** The inclusion of data obtained from angler trips in a given fishing mode that were opportunistically intercepted during surveys directed at other fishing modes could cause estimates of catch per angler trip to be biased.
 - 4.1. **Background:** Sampling for the intercept surveys is stratified by fishing mode, and a different site-day sampling frame is used for each mode. When an interviewer surveys a selected site-day unit, the primary objective is to find completed angler trips in the assigned fishing mode stratum. For example, an interviewer surveying a site-day unit selected for the shore mode stratum focuses on obtaining interviews with shore anglers who have finished fishing for the day. In this case, the assigned shore mode is the primary objective for the interviewing assignment. However, the intercept survey sampling protocols have traditionally allowed interviewers to also opportunistically obtain interviews with anglers who have finished fishing in modes other than the “assigned mode”. Such interviews are called “alternate mode” interviews, because they are not the primary objective of the selected site-day survey assignment. “Alternate mode” interviews have traditionally been pooled with “assigned mode” interviews, and the pooled data have been treated as a simple random sample of angler fishing trips in the estimation process. It is likely that the opportunistic “alternate mode” sample is not as representative as the probability based “assigned mode” sample, and it may need to be differentially weighted in some way, or eliminated entirely, to eliminate potential biases that could result from its inclusion in the estimation of mean catch per angler trip.
 - 4.2. **Assessment:** Interview data collected for intercepted angler trips in the “assigned mode” of fishing can be readily separated from data collected for intercepted angler trips in “alternate modes” of fishing. The mode of the assignment is stored in the “assignment summary data file” that has been required as a contract deliverable for the MRFSS intercept surveys since 1993.
 - 4.3. **Initiated Actions:** The assignment summary data files are being merged to the intercept trip files to uniquely flag trips in “assigned” or “alternate” modes.
 - 4.4. **Recommended Actions:** Alternate mode trip data should be excluded to run estimates of catch per angler trip based only on “assigned mode” trip data. Comparisons of estimates based on “assigned mode only” datasets with traditional estimates based on a mixed “assigned and alternate mode” dataset can be used to evaluate possible biases caused by the inclusion of the “alternate mode” trips. Improved estimation methods based on the inclusion of sample selection probabilities and cluster sampling assumptions should be developed to allow the determination of appropriate weighting factors to apply to the “alternate mode” trip data obtained on sampling assignments directed at other fishing modes. If

this is done, then it may be possible to include “alternate mode” interview data in the estimation calculations without causing any bias. Possible weighting methods for the unbiased inclusion of “alternate mode” data should be explored.

5. **Potential Bias Due to Estimation Error:** The inclusion of data from trips sampled at “alternate” sites adjacent to sites in the selected survey sample for a given mode of fishing may introduce an estimation bias if alternate site selection probabilities are not measured and used to appropriately weight data in the estimation equations.

- 5.1. **Background:** The current sampling protocol allows interviewers to visit up to two sites adjacent to the “assigned” site identified in each site-day unit selected for survey. Interviewing is allowed at “alternate” sites to maximize the cost-effectiveness and efficiency of sampling effort, but the inclusion of such sites effectively expands the bounds of the initially selected site-day unit to comprise a cluster of up to three adjacent sites per selected day. Because alternate sites have often been included, the assigned selection probability for the selected site-day assignment will not likely match the proportion of angler trips to be expected within the expanded 2-3 site cluster. Therefore, it may be difficult to determine appropriate weights to use in estimation equations that would help to assure proper probabilistic representation of trips from different sites in the total intercept survey sample.

- 5.2. **Assessment:** Interview data collected for intercepted angler trips at the “assigned site” can be readily separated from data collected for intercepted angler trips at “alternate sites”. The “assigned” site for every selected site-day interviewing assignment is stored in the both the “assignment draw” and the “assignment summary data” files that have been required deliverables for the intercept surveys since 1993. These files can be matched and checked to assure that the proper “assigned site” was visited for each selected and completed site-day assignment. The assignment summary data file includes the site codes for the assigned site and any alternate sites visited for all completed site-day interviewing assignments.

- 5.3. **Initiated Actions:** The assignment summary data files are being merged to the intercept trip files to uniquely flag trips intercepted at “assigned” or “alternate” sites.

- 5.4. **Recommended Actions:** “Alternate site” trip data should be excluded to run estimates of catch per angler trip based only on “assigned site” trip data. Comparisons of estimates based on “assigned site only” datasets with traditional estimates based on a mixed “assigned and alternate site” dataset can be used to evaluate possible biases caused by the inclusion of the “alternate site” trips that were sampled. Improved estimation methods based on the inclusion of sample selection probabilities and cluster sampling assumptions should be developed to allow the determination of appropriate weighting factors that can be applied to the “alternate site” trip data. If this is done, then it may be possible to include the alternate site trip data in the estimation calculations without causing any bias. Possible weighting methods for the unbiased inclusion of “alternate site” data are being explored.

6. **Potential Bias Due to Coverage Error:** The omission of certain sites, such as private shorelines, private docks, or private marinas from the intercept survey site list frames could result in significant estimation biases.
 - 6.1.**Background:** Because interviewers cannot legally gain access to private property to intercept anglers and collect data on completed fishing trips, private access sites have not been included in the site frames used for sampling. It has been assumed that the catch rates and catch compositions of angler fishing trips ending at private access sites are similar to those intercepted at the public access sites included in the intercept survey site frames. If that assumption is not correct, then the coverage error due to omission of such sites from the intercept survey frame could potentially cause biases in the survey estimates of catch per angler trip and total catch. The greater the proportion of trips occurring at the excluded private sites, the greater potential there would be for significant biases.
 - 6.2.**Assessment:** The bimonthly MRFSS Coastal Household Telephone Survey (CHTS) collects data on coastal zone resident fishing trips ending at both public and private access sites. These data can be analyzed to assess the proportions of trips occurring at public (included) and private (not included) sites in each state, two-month wave, and fishing mode. The proportions of public and private site trips taken by non-residents of the coastal zone covered by the CHTS cannot be assessed very well with current data. A new survey with broader coverage will be needed to collect such data from saltwater anglers who do not reside in the coastal zone. In 1998, the CHTS was extended to include coverage of non-coastal states of the U.S. Although the data collected in that 6-wave survey could be used to assess proportions of private and public site fishing trips by non-residents of the typical CHTS coastal zone, such an analysis will be limited by the fact that very few non-coastal households contacted during that survey actually reported saltwater fishing trips. Actual comparisons of catch rates or catch compositions between private and public site fishing trips cannot be made with existing data, because data on private trips is not available. A new survey based on a complete license-based angler list frame may be needed to collect the catch data needed to assess differences between public and private site trips.
 - 6.3.**Completed Actions:** Preliminary analyses of the proportions of private and public site trips reported in response to the CHTS have been conducted.
 - 6.4.**Recommended Actions:** The SAS programs used for those analyses should be modified for more thorough analyses. In order to evaluate possible differences between private and public access fishing trips, new surveys should be designed that would collect trip and catch data on both private and public site trips. New survey designs based on complete angler list frames should be explored.
7. **Potential Bias Due to Coverage Error:** The omission, or under-representation, of fishing trips that end at night could result in a temporal estimation bias.
 - 7.1.**Background:** Because interviews are not typically conducted at night, trips ending at night have been under-represented in the intercept survey data. It has been assumed that the catch rates and catch compositions of angler fishing trips ending at night are similar to those ending during daylight hours. If that assumption is not correct, then the coverage error due to under-representation of

fishing trips ending at night could potentially cause biases in the survey estimates of catch per angler trip and total catch for different species. The greater the proportion of trips ending at night, the greater potential there would be for significant biases.

7.2.Assessment: The bimonthly MRFSS Coastal Household Telephone Survey (CHTS) collects data on coastal zone resident fishing trips ending at all hours. These data can be analyzed to assess the proportions of trips ending during different time intervals in each state, two-month wave, and fishing mode. The proportions of nighttime and daytime trips taken by non-residents of the coastal zone covered by the CHTS cannot be assessed very well with current data. A new survey with broader coverage will be needed to collect such data from saltwater anglers who do not reside in the coastal zone. In one year, the CHTS was extended to include coverage of non-coastal states of the U.S. Although the data collected in that 6-wave survey could be used to assess proportions of trips by non-residents of the typical CHTS coastal zone in different 3-hour time intervals, such an analysis will be limited by the fact that very few non-coastal households contacted during that survey actually reported saltwater fishing trips. Actual comparisons of catch rates or catch compositions among trips ending in different time intervals cannot be made with existing data, because sufficient data on nighttime trips is not available. A new survey based on a complete license-based angler list frame may be needed to collect the catch data needed to assess differences among trips ending in different time intervals. Another possibility would be to include all time intervals in a re-designed intercept survey sampling design.

7.3.Completed Actions: Preliminary analyses of the proportions of trips in different time intervals as reported in response to the CHTS have been conducted.

7.4.Recommended Actions: The programs used for those analyses should be modified for more thorough analyses. In order to evaluate possible differences between daytime and nighttime fishing trips, new surveys should be designed that would collect trip and catch data on trips returning at all time intervals. New survey designs based on complete angler list frames should be explored.

8. Potential Bias Due to Coverage Error: The omission of some active public fishing sites from the current site-day frames used for intercept survey sampling may cause significant biases in survey estimates.

8.1.Background: Although a lot of work goes into developing and maintaining complete lists of public access sites for marine recreational fishing, it is possible that some active sites get excluded from the frame. This can cause estimation biases if angler trips ending at the excluded sites are different from those at included sites with respect to mean catch rate or catch composition.

8.2.Assessment: The master site register (MSR) for each state has been maintained in a standard format and all MSRs have been delivered and archived on a wave-by-wave basis for over 10 years. Master site registers used for past surveys can be readily compared because a standard data structure and format (including site names and descriptions, latitude/longitude coordinates, etc.) has been maintained since the early 1990's.

- 8.3.Completed Actions:** Programs have been developed to facilitate comparative analyses of site register data.
- 8.4.Recommended Actions:** The master site register used for the intercept surveys should be reviewed with the help of interstate commission and state agency partners, NMFS regional staff, and constituent representatives to ensure that all active sites are being included in the public site frames.
- 9. Potential Bias Due to Non-Response Error:** Failure to execute all of the site-day interviewing assignments selected as part of the intercept survey sample for a given spatiotemporal stratum could result in “non-response” errors that could significantly bias intercept survey estimates of mean catch per trip for a given fish species.
- 9.1.Background:** The set of site-day interviewing assignments selected for a given stratum of intercept survey sampling does not always get fully executed. Some assignments cannot be completed for various reasons despite concerted attempts to complete all. Once a list of site-day units has been selected to comprise the intercept survey sample for a given stratum, it is important to try to obtain observations for all units. Ideally, all selected site-day interviewing assignments units should be completed to assure that representative sampling has occurred. Any site-day interviewing assignments that do not get completed represent sampled units that were “not included” in the data set used for survey estimates. Failure to include all selected site-day units could result in a “non-response bias”, if there was a significant difference in the mean catch per angler trip between included and non-included units. As the level of non-inclusion of selected site-day sample units increases, the potential for significant biases increases.
- 9.2.Assessment:** Non-response rates and possible non-response biases for the intercept survey sampling can potentially be evaluated because “sample draw” and “sample completion” files have been required deliverables since the early 1990’s. The “sample draw” file for a given wave of sampling includes lists of all of the site-day samples that were selected for different strata. The “sample completion” file reports on all of the site-day interviewing assignments listed in the sample draw file, indicates which ones did not get completed, and provides a reason for each. Sample “non-response” rates can be obtained using the data in these files. In addition, possible spatiotemporal patterns in the “non-response” of selected site-day units can be studied.
- 9.3.Completed Actions:** Programs have been developed to merge the archived “sample draw” and “sample completion” files for all waves of the intercept surveys since the early 1990’s so that analyses of sample “non-inclusion” rates and patterns can be made.
- 9.4.Recommended Actions:** Historical data collected at different sites should be used to examine general spatiotemporal patterns in mean catch rates for key species. The matching of observed “non-response” patterns with such general patterns may be useful in assessing possible “non-response biases” that may have occurred.
- 10. Potential Bias Due to Sample Implementation Error:** The permitted rescheduling of site-day assignments in the selected intercept survey sample could change the

temporal distribution enough to cause significant biases in the survey estimates of mean catch per trip for different fish species.

- 10.1. **Background:** The intercept surveys have allowed contractors or grantees to reschedule selected site-day assignments to some extent. Rescheduling is generally discouraged, but some of it has been permitted to allow some flexibility in dealing with changing weather conditions. If kept to a minimum, such rescheduling would most likely have little impact on the temporal distribution of sampling relative to the true temporal distribution of fishing activity. However, if rescheduling is common it could potentially have a more significant impact.
- 10.2. **Assessment:** The “sample draw” and “assignment summary data” files can be used to check for any changes that may have occurred in the date of site-day assignments. The selected date of an assignment is always included in the original “sample draw” file. The “assignment summary data” file indicates the actual date when a site-day assignment was completed. Comparisons of the data in these files can be used to study rates of rescheduling and possible impacts on the temporal distribution of sampling through a “before and after”, or paired comparisons, type of approach.
- 10.3. **Completed Actions:** Programs have been developed to match the “sample draw”, “sample completion”, and “assignment summary data” files so that effective comparative analyses can be conducted to elucidate the extent and potential impacts of any significant temporal shifts caused by assignment rescheduling.
- 10.4. **Recommended Actions:** Comparative analyses should be performed to look for significant deviations from the expected sample distributions and to assess the potential biases caused by such deviations.

11. Potential Bias Due to Sample Implementation Error: If errors are made in the estimation of fishing activity for site-day units in the intercept survey sampling frames, then probability sampling will be less efficient and significant estimation biases could occur if appropriate corrections for the errors in sample design implementation are not measurable.

- 11.1. **Background:** Fishing activity estimates for different sites and day types are updated continuously to assure that the probability sampling approach accurately matches the distribution of sampling efforts with the true distribution of fishing efforts. Estimated fishing activity levels are used to assign selection probabilities such that sites and days with higher estimated activity have a greater probability of being selected for interviewing assignments. If the estimates of fishing activity for different sites and day types (weekend vs. weekday) are not accurate, then the resulting probability sample would be less efficient than desired and would not represent sites and days as much in proportion to their true activity levels as is desired. This can be problematic, causing potentially significant estimation biases if data cannot be properly weighted to compensate for the errors.
- 11.2. **Assessment:** The master site register (MSR) for each state has been maintained in a standard format and all MSRs have been delivered and archived on a wave-

by-wave basis for over 10 years. Data in MSRs used for past surveys can be readily analyzed for comparative analyses because a standard data structure and format for the estimates of fishing activity (also called fishing pressure) has been maintained since the early 1990's.

- 11.3. **Recommended Actions:** The MSR used for the intercept surveys should be reviewed with the help of interstate commission and state agency partners, NMFS regional staff, and constituent representatives to ensure that all included sites are being evaluated accurately for fishing activity. In addition, historical intercept survey data on the numbers of "eligible" angler trips observed at different sites on different day types should be analyzed and compared with the estimates of fishing activity in the MSR. Programs have been developed to facilitate comparative analyses of site register data with historical intercept survey data of site-day activity that is contained in the "assignment summary data" files.

12. **Potential Gains Due to Reduction of Sample Implementation Errors:** Many potential sample implementation errors can be prevented through improved training and supervision of survey staff and through improved monitoring of survey staff performance.

- 12.1. **Background:** Procedures are already in place for effective training and supervision of field personnel to assure proper implementation of survey sampling protocols. Procedures are also in place for ST1 monitoring of the implementation of intercept survey sampling protocols by contractor and grantee personnel. "Sample draw", "sample completion", and "assignment summary" data files are required deliverables that can be used for comparative analyses to determine when deviations from sampling protocols have occurred. It is possible to detect whether or not selected site-day assignments were completed, rescheduled, or cancelled. It is also possible to detect if appropriate alternate sites were chosen and determine if interviews were obtained in the assigned mode or an alternate mode. The proportions of "assigned site" (versus "alternate site") and "assigned mode" (versus "alternate mode") interviews can also be determined and monitored.
- 12.2. **Assessment:** NRC questioned whether current monitoring of interviewer performance of sampling protocols was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 12.3. **Initiated Actions:** Current methods for monitoring adherence to sampling protocols are being reviewed.
- 12.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by field supervisors, contractors, grantees, and ST1 staff. New standards should be set for when collected data will be considered unacceptable due to failed adherence to standard sampling protocols. Corrective actions should also be developed that will enhance the training and supervision of survey staff in ways that will increase adherence to the protocols.

- 13. Potential Gains Due to Reduction of Measurement Errors:** Many possible measurement errors can be prevented through improved training and supervision of survey staff and through improved monitoring of survey staff performance.
- 13.1. Background:** Procedures are already in place for effective training and supervision of field personnel to assure proper interviewing, measuring, and recording procedures are followed. Procedures are also in place for quality control of field interviewing and fish measuring procedures by supervisors and quality control of angler residence, angler avidity, fishing mode, fishing area, fish count, species identification, fish weight, fish length, and other data recorded on interview coding forms. A significant amount of monitoring of the data collection process is already practiced by contractor and grantee personnel. Field supervisors are required to visit each individual interviewer on site at least twice per year to observe their performance of standard data collection tasks. In addition, names and phone numbers of interviewed anglers are collected to allow confirmation and validation of at least 10% of all field interviews through follow-up telephone interviews.
- 13.2. Assessment:** NRC questioned whether current monitoring of interviewer performance of interviews, fish measurements, and fish species identifications was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 13.3. Initiated Actions:** Current methods for monitoring adherence to interviewing, fish identification, and fish measurement protocols are being reviewed.
- 13.4. Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by field supervisors, contractors, grantees, and ST1 staff. Unannounced visits by field supervisors and visits by independent contractors should be considered to improve field validation of the work of interviewers. Corrective actions should be developed that will enhance the training and supervision of survey staff in ways that will increase adherence to the protocols.
- 14. Potential Gains Due to Reduction of Processing Errors:** Many possible data processing errors can be prevented through improved training and supervision of data processing staff and through improved monitoring of the performance of pre-estimation tasks such as data coding, data entry, data editing, and imputation.
- 14.1. Background:** Procedures are already in place for effective training and supervision of data processing personnel to assure that errors are prevented. Procedures are also in place for quality control of processing tasks by interviewers, data entry staff, data editing staff, and ST1 staff. A significant amount of monitoring of processing tasks is already practiced by contractor and grantee personnel, as well as ST1 staff. Data entry programs have been designed to prevent key entry errors and flag possible coding errors. Flagged records are checked by highly trained data auditing personnel who follow specific instructions to contact field staff and determine appropriate corrections for obvious coding errors. Records of all changes made to data during the

editing process are provided as survey deliverables, and these records are routinely checked by ST1 staff.

- 14.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 14.3. **Initiated Actions:** Current methods for monitoring adherence to data processing protocols are being reviewed.
- 14.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by contractors, grantees, and ST1 staff.

15. Potential Gains Due to Reduction of Estimation Errors: Possible errors in the implementation of estimation procedures can be prevented through improved monitoring of the performance of programmers involved in developing, updating, and maintaining the SAS programs used to produce survey point estimates, variance estimates, and confidence intervals.

- 15.1. **Background:** Procedures are already in place for effective training and supervision of SAS programmers for the surveys to assure that programming errors are prevented. Some procedures are also in place for the quality control of programming tasks by ST1 staff. However, new programs developed by one programmer for new estimation tasks have not always been reviewed by other programmers to check for possible problems.
- 15.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 15.3. **Initiated Actions:** Current methods for reviewing and validating the performance of new or modified SAS programs are being reviewed
- 15.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard quality assurance methods.

16. Improved Documentation of Survey Protocols: In order to better understand possible problems with current survey protocols, updated documentation of those protocols into one standard reference is needed.

- 16.1. **Background:** The descriptions of standard procedures for conduct of intercept survey operations is currently scattered among a number of different documents, including technical reports, contract statements of work, and survey training manuals. Descriptions of some tasks vary to some extent among the different documents.
- 16.2. **Assessment:** There is a need to develop one standard reference that describes all of the standard survey operations. This is important because consistent performance of sample selection, data collection, data processing, and statistical estimation tasks in accordance with the survey design requires that all people involved in conduct of the survey have the same understanding of how the respective tasks should be performed. This reference document will be important for supporting evaluations of possible procedural improvements.

- 16.3. **Initiated Actions:** A reference document that describes all of the standard operating procedures for the intercept surveys in each region is currently being developed.
- 16.4. **Recommended Actions:** Descriptions of standard operating procedures should be updated as changes in survey methodology are made. Descriptions of standard procedures and protocols that appear in the various documents supporting the performance of the survey should always be modified to match the standard reference.

Large Pelagics Survey – Large Pelagics Intercept Survey (LPIS):

1. **Potential Bias Due to Estimation Error:** Because site-day sample selection probabilities are not used in estimation equations, both point and variance estimates of catch per vessel trip may be biased.
 - 1.1. **Background:** The sampling for the on-site LPIS is initially based on a probability sample of clustered site-day units listed in a site-cluster x day matrix frame. A “site cluster” is made up of one or more sites on the site register that are clustered together as a sample unit. Interviewers are instructed to try to visit all sites within any given cluster that is assigned. Selection probabilities for different site-cluster-day units in the frame are assigned in relation to expected amount of active vessels to be encountered. The probability sampling of site-cluster-day units is intended to assure representative sampling of vessel trips among the sites included in the list frame. Site-cluster-day units with more vessel fishing trips should have a higher probability of inclusion in the sample than units with fewer trips. If only one vessel trip was intercepted in each selected site-cluster-day sample unit and the selection probabilities of site-cluster-day units accurately reflected the proportions of total vessel trips encountered within those units, the resulting sample of vessel trips should be representative and no weighting of data would be needed. However, for obvious economic reasons the sampling protocols encourage intercepts of more than one vessel trip per selected site-day unit. This could result in an over-representation of vessel trips occurring within site-days with higher fishing activity. A bias would result if mean vessel catch rates differed significantly between high and low activity site-day units.
 - 1.2. **Assessment:** The current method for estimating mean catch per vessel trip from the intercept survey data does not take the site-cluster-day sample selection probabilities into account. The NRC review suggested that the selection probabilities could be used as weighting factors in the estimation equations to appropriately correct for any biases that may be caused by a consistent over-representation of trips within high (or low) activity site-cluster-day units. The sampling frames and selection probabilities assigned to different site-cluster-day units have been maintained in separate data files for each two-month wave of sampling since 2002.
 - 1.3. **Completed Actions:** The sampling frames used for the collection of historical LPIS data have been retrieved and matched with “sample draw” databases containing the actual units selected for sampling. Alternative equations that

incorporate the appropriate probability sampling weighting factors are being evaluated.

- 1.4. **Recommended Actions:** The site-day selection probabilities should be extracted and merged into the intercept survey data files so that they can be used to differentially weight sampled vessel trip data in the estimation process. Estimation equations should be developed that perform the necessary differential weighting of data. Estimates should be generated with the new equations and compared to those generated with the current equations to assess the magnitude and direction of any apparent biases in the current approach.

2. **Potential Bias Due to Estimation Error:** Because the multi-stage cluster sampling design of the LPIS is not taken into account in LPS estimation equations, both point and variance estimates of catch per vessel trip may be biased.

- 2.1. **Background:** The LPIS uses a multi-stage cluster sampling design that is not currently taken into account in the estimation equations. Once a given site-cluster-day unit in the frame has been selected, it is assigned to an intercept survey interviewer. The interviewer is instructed to survey an assigned cluster of sites on an assigned day by intercepting and interviewing vessel operators who have completed fishing. Since it may not always be possible to visit every site within the assigned cluster for an interviewing assignment, the cluster of sites may actually be subsampled. At each site that is visited, it may not be possible to intercept and interview every eligible vessel operator that the interviewer observes. Therefore, clusters of vessel trips within visited sites are also frequently subsampled.

- 2.2. **Assessment:** The sample of vessel trips obtained from the sampling of site-cluster-day frame units is treated like a simple random sample of vessel trips in the equations used to estimate mean catch per vessel trip. In order to properly take the two-stage cluster sampling of vessel trips into account in the estimation equations, one must know the actual sizes of the respective clusters, and the cluster memberships of each sampled vessel trip must be known. Data on cluster sizes and cluster membership have been collected by the LPS intercept surveys since 2002. These data can be used to develop appropriate estimation equations that will correct for any possible point estimate, or variance estimate, biases that could result from assuming that a simple random sample of vessel trips was obtained.

- 2.3. **Completed Actions:** The data on cluster sizes and membership have been merged with vessel trip data so that the cluster sampling design can be taken into account when the data are used for estimation of mean catch per vessel trip. Alternative equations to incorporate the effects of the cluster sampling design are being evaluated.

- 2.4. **Recommended Actions:** Data on the numbers of “eligible” vessel trips missed in each sampled site-cluster-day cluster of trips should be used in combination with data on the numbers of intercepted eligible trips to determine the total number of trips encountered in each sampled site-cluster-day unit. Estimation equations should be developed that incorporate the cluster sampling design, including the subsampling of clusters at different levels. Comparisons should be

made between estimates produced with and without this improvement to determine the magnitude and direction of any possible biases.

3. **Potential Bias Due to Estimation Error:** Because the multi-stage cluster sampling design of the LPIS has not been taken into account in estimation equations, both point and variance estimates of mean length of landed catch may be biased.
 - 3.1. **Background:** The LPIS uses a multi-stage cluster sampling design for obtaining measurements on landed fish that is not currently taken into account in the estimation equations used for mean length estimates or estimates of length frequency distributions. The samples of landed fish of each species that are measured for length data are not simple random samples. They are actually samples obtained by the subsampling of day clusters of sites, the subsampling of site clusters of vessels, and the subsampling of clusters of fish landed by different vessels. Each intercepted vessel potentially provides a cluster of landed fish for measurements. Since it is not always possible to obtain length measurements on all fish landed by a given intercepted vessel, a systematic subsample of fish is selected for measurements. The sample of fish measurements obtained from the multi-stage cluster sampling design is treated like a simple random sample of landed fish in the equations used to estimate either the mean length or length distributions of landed fish.
 - 3.2. **Assessment:** In order to properly take the three-stage cluster sampling of landed fish within each site-cluster-day into account in the estimation equations, one must know the actual sizes of the respective clusters, as well as the day cluster, site cluster, and vessel cluster memberships of each measured fish. Data on cluster sizes and cluster membership have been collected by the LPIS since 2002. These data can be used to develop appropriate estimation equations that could correct for any possible biases in point estimates, or variance estimates, that could result from assuming that a simple random sample of landed fish was obtained.
 - 3.3. **Completed Actions:** The data on cluster sizes and membership have been merged with vessel trip data so that the cluster sampling design can be taken into account when the data are used for estimation of mean lengths of landed fish. Alternative equations to incorporate the effects of the cluster sampling design are being evaluated.
 - 3.4. **Recommended Actions:** Data on the numbers of eligible trips missed in each sampled day cluster of trips should be used in combination with data on the numbers of intercepted eligible trips to determine the total number of trips encountered in each sampled site-cluster-day unit. Data on the number of vessel trips that occurred at the same site should be used to determine the size of each subsampled site cluster of trips. Data on the number of fish that were landed by each vessel should be used to determine the size of each subsampled vessel cluster of landed fish. Estimation equations should be developed that incorporate the cluster sampling design, including the subsampling of clusters at different levels.

4. **Potential Bias Due to Estimation Error:** The inclusion of data obtained from vessel trips in a given fishing mode that were opportunistically intercepted during the LPIS sampling directed at another fishing mode could cause estimates of catch per vessel trip to be biased.
 - 4.1. **Background:** Sampling for the LPIS has been stratified by fishing mode in some years. In such years, a different site-cluster-day sampling frame was used for each mode. When an interviewer surveys a selected site-cluster-day unit, the primary objective is to find completed vessel trips in the assigned fishing mode stratum. For example, an interviewer surveying a site-cluster-day unit selected for the private boat mode stratum focuses on obtaining interviews with private boat captains whose vessel has finished fishing for the day. In this case, the assigned private boat mode is the primary objective for the interviewing assignment. However, the LPIS sampling protocols have traditionally allowed interviewers to also obtain interviews with operators of both private boats and for-hire boats who have finished fishing for the day. Interviews in a mode other than the assigned mode are called “alternate mode” interviews, because they are not the primary objective of the selected site-day survey assignment. “Alternate mode” interviews have traditionally been pooled with “assigned mode” interviews, and the pooled data have been treated as a simple random sample of vessel fishing trips in the estimation process. It is likely that the opportunistic “alternate mode” sample is not as representative as the probability based “assigned mode” sample, and it may need to be differentially weighted in some way, or eliminated entirely, to eliminate potential biases that could result from its inclusion in the estimation of mean catch per vessel trip.
 - 4.2. **Assessment:** Interview data collected for intercepted vessel trips in the “assigned mode” of fishing can be readily separated from data collected for intercepted vessel trips in “alternate modes” of fishing. The mode of the assignment is stored in the “assignment summary data file” that has been required as a contract deliverable for the LPS intercept surveys since 2002. The assigned mode can be merged to the intercept trip files to flag trips intercepted in an “alternate mode”.
 - 4.3. **Initiated Actions:** The assignment summary data files are being merged to the intercept trip files to uniquely flag trips in “assigned” or “alternate” modes.
 - 4.4. **Recommended Actions:** Alternate mode trip data should be excluded to run estimates of catch per vessel trip based only on “assigned mode” trip data. Comparisons of estimates based on “assigned mode only” datasets with estimates based on a mixed “assigned and alternate mode” dataset can be used to evaluate possible biases caused by the inclusion of the “alternate mode” trips. Improved estimation methods based on the inclusion of sample selection probabilities and cluster sampling assumptions should be developed to allow the determination of appropriate weighting factors to apply to the “alternate mode” trip data obtained on sampling assignments directed at the other fishing mode. If this is done, then it may be possible to include “alternate mode” interview data in the estimation calculations without causing any bias. Possible weighting methods for the unbiased inclusion of “alternate mode” data are being explored.

5. **Potential Bias Due to Non-Response Error:** Failure to execute all of the site-cluster-day interviewing assignments selected as part of the LPIS sample for a given spatiotemporal stratum could result in a “non-response error” that could cause significant biases in survey estimates of mean catch per vessel trip for different fish species.
 - 5.1. **Background:** The set of site-cluster-day interviewing assignments selected for a given stratum of LPIS sampling does not always get fully executed. Some assignments cannot be completed for various reasons despite concerted attempts to complete all. Once a list of site-cluster-day units has been selected to comprise the intercept survey sample for a given stratum, it is important to try to obtain observations from all units in the sample. Ideally, all selected site-cluster-day interviewing assignments units should be completed to assure that true probability sampling has occurred. Any site-cluster-day interviewing assignments that do not get completed represent sampled units that were not included in the data set used for survey estimates. Failure to include all selected units could result in a “non-response bias”, if there was a significant difference in the mean catch per vessel trip between included and non-included units. As the level of non-inclusion of selected site-day sample units increases, the potential for significant estimation biases increases. Assignments that are not completed due to “weathering out” are not considered to be a potential source of “non-response bias.” The assumption here is that no LPS trips returned to the sites within the assigned cluster on “weathered out” days.
 - 5.2. **Assessment:** Non-inclusion rates and possible non-response biases for the intercept survey sampling can potentially be evaluated because “sample draw” and “sample completion” files have been required deliverables since 2002. The “sample draw” file for a given wave of sampling includes lists of all of the site-cluster-day samples that were selected for different strata. The “sample completion” file reports on all of the interviewing assignments listed in the sample draw file, indicates which ones did not get completed, and provides a reason for each. Sample “non-inclusion” rates can be obtained using the data in these files. In addition, possible spatiotemporal patterns in the “non-inclusion” of selected site-day units can be studied.
 - 5.3. **Completed Actions:** Programs have been developed to merge the archived “sample draw” and “sample completion” files for all months of the intercept surveys since 2002 so that analyses of sample “non-inclusion” rates and patterns can be made.
 - 5.4. **Recommended Actions:** Historical data collected at different sites should be used to examine general spatiotemporal patterns in mean catch rates for key species. The matching of observed sample “non-response” patterns with such general patterns should be useful in assessing possible biases that may have occurred.
6. **Potential Bias Due to Sample Implementation Error:** The permitted rescheduling of site-day assignments in the selected LPIS sample can potentially result in a temporal shift of the sample that could significantly bias survey estimates of mean catch per vessel trip for different fish species.

- 6.1. **Background:** While rescheduling of LPIS assignments is generally discouraged, contractors do have to reschedule sometimes due to interviewer illness or other unexpected problems. If kept to a minimum, such rescheduling would most likely have little impact on the temporal distribution of the sample relative to the true temporal distribution of fishing activity. However, if rescheduling is common it could potentially have a more significant impact.
 - 6.2. **Assessment:** The “sample draw” and “assignment summary data” files can be used to check for any changes that may have occurred in the date of site-cluster-day assignments. The selected date of an assignment is always included in the original “sample draw” file. The “assignment summary data” file indicates the actual date when a site-day assignment was completed. Comparisons of the data in these files can be used to study rates of rescheduling and possible impacts on the temporal distribution of sampling through a “before and after”, or paired comparisons, type of approach.
 - 6.3. **Completed Actions:** Programs have been developed to match the “sample draw”, “sample completion”, and “assignment summary data” files so that effective comparative analyses can be conducted.
 - 6.4. **Recommended Actions:** Comparisons should be made to reveal potential biases that may have been caused by the rescheduling of interviewing assignments.
7. **Potential Bias Due to Coverage Error:** The omission of private docks and private marinas from the LPIS site list frames could cause significant biases in survey estimates.
 - 7.1. **Background:** Because interviewers cannot legally gain access to private property to intercept vessel operators and collect data on completed fishing trips, private access sites have not been included in the site frames used for sampling. This represents an error in coverage of the sample frame. It has been assumed that the catch rates and catch compositions of vessel fishing trips ending at private access sites are similar to those intercepted at the public access sites included in the intercept survey site frames. If that assumption is not correct, then the private access coverage error could potentially cause biases in the survey estimates of mean catch per vessel trip and total catch. The greater the proportion of trips occurring at the excluded private sites, the greater potential there would be for the coverage error to cause a significant bias.
 - 7.2. **Assessment:** The Large Pelagics Telephone Survey (LPTS) and FHS collect data on the fishing trips of HMS vessels at both public and private access sites. These data has been analyzed to assess the proportions of trips occurring at public (included) and private (not included) sites in each state, week, month, and/or fishing mode. It is possible that the proportions of public and private site trips taken by HMS permit holders cannot be adequately assessed with current data because significant numbers of vessel operators may have purchased their permit too late to be included in the LPTS or FHS directory frames. If such late registrants are more or less likely to fish from private access sites, a new survey with broader coverage may be needed to perform a more accurate assessment of the proportions of private and public access effort. Some comparisons of catch rates or catch compositions between private and public site fishing trips can be

made with existing data, because catch data for certain species on both public and private has been collected in several years by the traditional LPTS. Additional questions may need to be added to the phone surveys to collect catch data on more commonly caught large pelagics (e.g. yellowfin tuna, dolphin). A new survey may be needed to collect the catch data needed to assess differences between public and private site trips for all HMS species.

- 7.3. **Completed Actions:** Preliminary analyses of the proportions of private and public site trips reported in response to the LPTS have been conducted. Preliminary analyses of LPTS data have also focused on evaluating differences in mean catch rates of bluefin tuna between private and public site trips.
- 7.4. **Recommended Actions:** The SAS programs used for preliminary analyses should be modified for more thorough analyses. In order to evaluate possible differences between private and public access fishing trips, new surveys should be designed that would collect trip and catch data on both private and public site trips.

8. **Potential Bias Due to Coverage Error:** The omission, or under-representation, of fishing trips that end at night or in the morning could result in a temporal estimation bias.

- 8.1. **Background:** Because sampling is not typically conducted at night or during the morning hours, vessel trips returning at times outside of 3-9PM have been under-represented in the LPIS data. It has been assumed that the catch rates and catch compositions of vessel trips ending at other times are similar to those ending during the 3-9PM interval. If that assumption is not correct, then the under-representation of “off-hour” trips could potentially bias survey estimates of catch per vessel trip and total catch. The greater the proportion of trips ending outside of 3-9PM, the greater potential there would be for a significant bias.
- 8.2. **Assessment:** The LPTS collects data on HMS permit holder trips ending at all hours. These data can be analyzed to assess the proportions of vessel trips ending during different time intervals in each state, week, month, and/or fishing mode. It is possible that the proportions of trips taken by HMS permit holders during different time intervals cannot be adequately assessed with current data because significant numbers of vessel operators may have purchased their permit too late to be included in the LPTS or FHS directory frames. If such late registrants are more or less likely to finish fishing in the 3-9PM interval, a new survey with broader coverage may be needed to perform a more accurate assessment of the proportions of trips in different time intervals. Actual comparisons of catch rates or catch compositions among trips ending in different time intervals can be made for some species with existing data, because catch data for some HMS were obtained by the LPTS in several years. However, a new survey may be needed to collect the catch data needed to assess differences among trips ending in different time intervals. Another possibility would be to include all time intervals in a re-designed intercept survey sampling design.
- 8.3. **Completed Actions:** Preliminary analyses of the proportions of trips in different time intervals, as reported in response to the LPTS, have been conducted.

Preliminary analyses of LPTS data have also focused on evaluating differences in mean catch rates of bluefin tuna among different time intervals.

- 8.4. **Recommended Actions:** The SAS programs used for preliminary analyses should be modified for more thorough analyses. In order to evaluate possible differences among trips ending in different time intervals, new surveys should be designed that would collect trip and catch data over all time periods.

- 9. **Potential Bias Due to Coverage Error:** The omission of some active public fishing sites for HMS from the current site-cluster-day frames used for LPIS sampling may result in a significant estimation bias.

- 9.1. **Background:** Although a lot of work goes into developing and maintaining complete lists of public access sites for marine recreational fishing for HMS, it is possible that some active sites get excluded from the survey frames. Such errors in frame coverage can cause estimation biases if vessel trips ending at the excluded sites are different from those at included sites with respect to mean catch rate or catch composition.

- 9.2. **Assessment:** The master site register (MSR) for each state has been maintained in a standard format and all MSRs have been delivered and archived on a month-by-month basis. Master site registers used for past surveys can be readily compared because a standard data structure and format (including site names and descriptions, latitude/longitude coordinates, etc.) has been maintained since 2002. Data on the site locations of HMS vessel trips reported in response to the For-Hire Telephone Survey and the Large Pelagics Telephone Survey can be used to evaluate the completeness of the MSR for the LPIS.

- 9.3. **Completed Actions:** Programs have been developed to facilitate comparative analyses of MSR data.

- 9.4. **Recommended Actions:** The master site register used for the LPS intercept surveys should be reviewed with the help of state agency partners, NMFS regional staff, and constituent representatives to ensure that all active sites are being included in the public site frames. Programs have been developed to facilitate comparative analyses of site register data. Telephone survey data on actual site locations of vessel trips should be compared with the MSR to determine if active sites for HMS fishing were missed.

- 10. **Potential Bias Due to Coverage Error:** Oversampling of tournaments in the LPIS could potentially bias point and variance estimates of catch per trip.

- 10.1. **Background:** The LPIS obtains interviews from both tournament and non-tournament offshore trips targeting large pelagic species. The assumption is that tournament and non-tournament trips are represented in the right proportions in the LPIS sample of vessel trips. If this is not the case and tournament trips differ from non-tournament trips in mean catch per trip, then the point and variance estimates of mean catch per trip produced by the LPIS may be biased. Since tournaments often offer cash and other prizes for the largest fish of certain target species, the size and species compositions of tournament trip catches may also differ from that of non-tournament trips.

Tournaments may also attract more experienced and successful captains who may tend to have higher catch rates.

- 10.2. **Assessment:** Ideally tournament and non-tournament trips should be represented in the correct proportions to assure unbiased estimates. Since tournament information is collected on the LPS telephone surveys (both LPTS and FHS add-on) it is possible to calculate the proportion of HMS vessel trips associated with tournaments using phone survey data. If this proportion is significantly lower than that obtained from the LPIS than tournaments are likely being oversampled. LPIS data can be used to compare catch rates between tournament and non-tournament trips. A new approach may be needed for sampling tournaments. Tournament fishing and non-tournament fishing could possibly be treated as separate LPIS strata that are surveyed independently. There may also be potential to use data from the RBS (Recreational Billfish Survey) in an integrated approach or as part of a dual-frame methodology.
- 10.3. **Completed Actions:** An initial analysis of tournament trips comparing phone and intercept survey data is underway. ST1 staff are considering new methods for sampling tournament fishing trips.
- 10.4. **Recommended Actions:** Continue to analyze whether or not over (or under) sampling of tournaments is resulting in a bias and, if so, the extent of the bias. ST1 should continue to explore new methods for sampling highly migratory species tournaments. ST1 should also work with SEFSC on ways of integrating the RBS and the LPS or developing a dual-frame approach to sampling tournaments.

11. Potential Bias Due to Sample Implementation Error: If errors are made in the estimation of vessel fishing activity for site-cluster-day units in the intercept survey sampling frames, then probability sampling will be less efficient and significant estimation biases could occur if appropriate corrections for the errors in sample design implementation are not measurable.

- 11.1. **Background:** Fishing activity estimates for different sites and day types are updated continuously to assure that the probability sampling approach accurately matches the distribution of sampling efforts with the true distribution of fishing efforts. Estimated fishing activity levels are used to assign selection probabilities such that sites and days with higher estimated activity have a greater probability of being selected for interviewing assignments. If the estimates of fishing activity for different sites and day types (weekend/holiday vs. weekday) are not accurate, then the resulting probability sample would be less efficient than desired and would not represent sites and days as much in proportion to their true activity levels as is desired. This can be problematic, causing potentially significant estimation biases if data cannot be properly weighted to compensate for the errors.
- 11.2. **Assessment:** The master site register (MSR) for each state has been maintained in a standard format and all MSRs have been delivered and archived on a month-by-month basis for the last 5 years. Data in MSRs used for past surveys can be readily analyzed for comparative studies because a standard data structure and format for the estimates of fishing activity (also called fishing

pressure) has been maintained since the 2002. Data on the site locations of HMS vessel trips reported in response to the For-Hire Telephone Survey and the Large Pelagics Telephone Survey can be used to evaluate the accuracy of vessel activity estimates estimated for sites in the MSR for the LPIS.

- 11.3. **Completed Actions:** Programs have been developed to facilitate comparative analyses of MSR data.
- 11.4. **Recommended Actions:** The MSR should be reviewed with the help of state agency partners, NMFS regional staff, and constituent representatives to ensure that all included sites are being evaluated accurately for HMS fishing activity. In addition, historical intercept survey data on the numbers of “eligible” vessel trips observed at different sites on different day types should be analyzed and compared with the estimates of fishing activity in the MSR. Data on fishing port locations obtained in the LPS telephone survey should also be analyzed and compared with the MSR activity estimates. Programs have been developed to facilitate comparative analyses of site register data with historical intercept survey data of site-day activity that is contained in the “assignment summary data” files. Telephone survey data on actual site locations of vessel trips should be compared with the MSR to determine if activity estimates for HMS fishing were accurate

- 12. **Potential Bias Due to Measurement Error:** If LPIS interviewers accidentally record curved length instead of straight length measurements for bluefin tuna landed by intercepted vessels, then the estimates of mean length used to develop estimates of mean weight and total weight of landings could be positively biased.

- 12.1. **Background:** This issue was raised in recent years because the size categories used for bluefin tuna management are defined by curved length measurements. LPIS interviewers have always been instructed to obtain straight lengths when taking measurements of observed landed fish. Constituents claimed that they had observed interviewers measuring and recording curved lengths rather than straight lengths. ST1 was asked to lead a multi-Office (F/ST, F/SF, F/IA, and F/SEFSC) effort to evaluate the potential for errors in the estimation of mean lengths that may be caused by occasional or frequent recording of curved length measurements instead of straight length measurements.
- 12.2. **Assessment:** Curved length measurements reported on catch cards submitted to Maryland DNR and in automated landings reports for other states were available to be compared with measurements recorded for the same fish by LPS interviewers through a paired comparisons approach.
- 12.3. **Completed Actions:** The multi-Office team developed and executed a plan to compare LPS bluefin tuna length measurements with measurements reported for the same fish from a different source. The results of analyses were used to estimate the extent of a possible bias in LPS catch estimates that may have resulted from the reporting of curved lengths by LPS interviewers.

- 13. **Potential Bias Due to Measurement Error:** If the database used for calculating appropriate length-to-weight conversions for bluefin tuna is based on a size range of fish that is not representative of the current recreational fishery, then the LPS

estimates of mean weight and total weight of landings that are based on such conversions may be biased.

- 13.1. **Background:** Southeast Center staff had been using a historical purse seine landings database with bluefin tuna length and weight data to calculate appropriate conversion factors that could be used to convert LPIS mean length estimates into mean weight estimates. Constituents questioned whether the database used to determine the conversions was truly representative of the current recreational fishery, suggesting that there may be biases in the estimates of mean weight and total weight of bluefin tuna landings in recent years. ST1 was asked to lead a multi-Office effort (F/ST, F/SF, and F/SEFSC) to evaluate the potential for bias in the conversion factors used for determining mean weight estimates. In addition, ST1 was asked to lead an effort to assess the potential impact that biases of different magnitudes could have on stock projections for bluefin tuna.
- 13.2. **Assessment:** Three independent databases with bluefin tuna length and weight data were available to use for comparisons. One data set was obtained through biological sampling surveys conducted as part of the LPS Program in the late 1990's.
- 13.3. **Completed Actions:** The multi-Office team performed statistical analyses that compared length/weight relationships in the three independent sets of bluefin tuna length and weight data. Results of the analyses showed that the length/weight relationships for the different bluefin tuna size classes were similar between the historical purse seine data set and the recent LPS biological sampling data set. This suggested that the traditional conversion factors were unbiased and appropriate for calculating unbiased mean weight estimates from the mean length estimates provided by the LPS for each size class. Additional LPS biological sampling was collected in 2006. Further data collections in subsequent years are planned to build a length/weight database that can be used to support future analyses and develop up-to-date length-to-weight conversion equations. ST1 is involved in a NERO Cooperative Research Proposal to work with states, industry members and academia on collecting additional bluefin tuna lengths and weights during the 2007 fishing season.

14. **Potential Bias Due to Measurement Error:** If interviewers are not properly trained, they could make errors in the identification of fish species, and if such errors were common they could cause significant biases in the survey estimates of mean catch per trip for different species.

- 14.1. **Background:** Although the contract statement of work includes specific requirements for the training and supervision of interviewers to assure that they can accurately identify observed fish to the species level on a consistent basis, mistakes do occur from time to time. In cases where fish are reported by an interviewed vessel operator and a trained interviewer cannot directly observe the fish, it is important to provide good guidance that will promote more accurate species IDs. NRC expressed concern that errors in species identification could be frequent enough to cause significant biases in survey estimates.

- 14.2. **Assessment:** It is always helpful to find improved field guides that provide clearer information on how to accurately distinguish between fish of different species that look similar.
- 14.3. **Completed Actions:** ST1 staff have been working with SF/HMS and NERO staff to develop, publish, and distribute improved fish identification guides for survey workers and fishermen. A water-proof guide for identifying tunas (*Guide to the Tunas of the Western Atlantic Ocean*) was recently updated, published, and distributed to captains, mates, anglers, and other fishing industry participants.
- 14.4. **Initiated Actions:** ST1 has discussed development of a new shark identification card with the NMFS Apex Predator Lab in Narragansett.
15. **Potential Gains Due to Reduction of Sample Implementation Errors:** Many potential sample implementation errors can be prevented through improved training and supervision of survey staff and through improved monitoring of survey staff performance.
- 15.1. **Background:** Procedures are already in place for effective training and supervision of field personnel to assure proper implementation of survey sampling protocols. Procedures are also in place for ST1 monitoring of the implementation of LPIS sampling protocols by contractor personnel. “Sample draw”, “sample completion”, and “assignment summary” data files are required deliverables that can be used for comparative analyses to determine when deviations from sampling protocols have occurred. It is possible to detect whether or not selected site-cluster-day assignments were completed, rescheduled, or cancelled.
- 15.2. **Assessment:** NRC questioned whether current monitoring of interviewer performance of sampling protocols was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 15.3. **Completed Actions:** ST1 has already implemented several quality assurance and quality control improvements to the LPIS. These include close monitoring of several interviewer performance measures, weekly monitoring reports, weekly status calls with contractors, data review meetings and regional meetings, and survey start-up meetings with contractors and field supervisors. ST1 staff have attended LPIS training sessions and conducted their own site visits and quality assurance field visits. ST1 and contractor have also designed and implemented a new quality control field visit questionnaire.
- 15.4. **Initiated Actions:** Current methods for monitoring adherence to sampling protocols are being reviewed.
- 15.5. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by field supervisors, contractors, and ST1 staff. New standards should be set for when collected data will be considered unacceptable due to failed adherence to standard sampling protocols. Corrective actions should also be developed that will enhance the training and supervision of survey staff in ways that will increase adherence to the LPIS protocols.

- 16. Potential Gains Due to Reduction of Measurement Errors:** Many possible measurement errors can be prevented through improved training and supervision of survey staff and through improved monitoring of survey staff performance.
- 16.1. Background:** Procedures are already in place for effective training and supervision of LPIS field personnel to assure proper interviewing, measuring, and recording procedures are followed. Procedures are also in place for quality control of field interviewing and fish measuring procedures by supervisors and quality control of vessel identifiers, fishing mode, fishing area, fish count, species identification, fish weight, fish length, and other data recorded on interview coding forms. A significant amount of monitoring of the data collection process is already practiced by contractor and grantee personnel. Field supervisors are required to visit each individual interviewer on site at least twice per year to observe their performance of standard data collection tasks. In addition, names and phone numbers of interviewed anglers and captains are collected to allow confirmation and validation of at least 10% of all field interviews through follow-up telephone interviews.
- 16.2. Assessment:** NRC questioned whether current monitoring of interviewer performance of interviews, fish measurements, and fish species identifications was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 16.3. Completed Actions:** ST1 has already implemented several quality assurance and quality control improvements to the LPIS. These include close monitoring of several interviewer performance measures, weekly monitoring reports, weekly status calls with contractors, data review meetings and regional meetings, and survey start-up meetings with contractors and field supervisors. ST1 staff have attended LPIS training sessions and conducted their own site visits and quality assurance field visits. ST1 and contractor have also designed and implemented a new quality control field visit questionnaire. ST1 revised the LPIS SOW to require that at least 50% of the field supervisor visits are unannounced.
- 16.4. Initiated Actions:** Current methods for monitoring adherence to interviewing, fish identification, and fish measurement protocols for the LPIS are being reviewed.
- 16.5. Recommended Action:** Recommendations should be developed for more rigorous standard monitoring methods to be used by field supervisors, contractors, grantees, and ST1 staff. Corrective actions should be developed that will enhance the training and supervision of survey staff in ways that will increase adherence to the LPIS protocols.
- 17. Potential Gains Due to Reduction of Processing Errors:** Many possible data processing errors can be prevented through improved training and supervision of data processing staff and through improved monitoring of the performance of pre-estimation tasks such as data coding, data entry, data editing, and imputation.

- 17.1. **Background:** Procedures are already in place for effective training and supervision of LPIS data processing personnel to assure that errors are prevented. Procedures are also in place for quality control of processing tasks by interviewers, data entry staff, data editing staff, and ST1 staff. A significant amount of monitoring of processing tasks is already practiced by contractor personnel and ST1 staff. Data entry methods have been designed to prevent transcription errors and flag possible coding errors. OCR (optical character recognition) is used for LPIS data to help reduce data entry errors. Flagged records are checked by highly trained data auditing personnel who follow specific instructions to contact field staff and determine appropriate corrections for obvious coding errors. Records of all changes made to data during the editing process are provided as survey deliverables, and these records are routinely checked by ST1 staff.
- 17.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 17.3. **Initiated Actions:** Current methods for monitoring adherence to LPIS data processing protocols are being reviewed.
- 17.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by contractors, grantees, and ST1 staff.

18. Potential Gains Due to Reduction of Programming Errors: Possible errors in the implementation of LPIS estimation procedures can be prevented through improved monitoring of the performance of programmers involved in developing, updating, and maintaining the SAS programs used to produce survey point estimates, variance estimates, and confidence intervals.

- 18.1 **Background:** Procedures are already in place for effective training and supervision of SAS programmers for the LPIS to assure that programming errors are prevented. Some procedures are also in place for the quality control of programming tasks by ST1 staff. However, new programs developed by one programmer for new estimation tasks have not always been reviewed by other programmers to check for possible problems.
- 18.2 **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
- 18.3 **Initiated Actions:** Current methods for reviewing and validating the performance of new or modified SAS programs for the LPIS are being reviewed.
- 18.4 **Recommended Action:** Recommendations should be developed for more rigorous standard quality assurance methods to be used by ST1 staff.

19. Improved Documentation of Survey Protocols: In order to better understand possible problems with current survey protocols, updated documentation of those protocols into one standard reference is needed.

- 19.1 **Background:** The descriptions of standard procedures for conduct of intercept survey operations are currently scattered among a number of different documents, including technical reports, contract statements of work, and survey training manuals. Descriptions of some tasks vary to some extent among the different documents.
- 19.2 **Assessment:** There is a need to develop one standard reference that describes all of the standard survey operations. This is important because consistent performance of sample selection, data collection, data processing, and statistical estimation tasks in accordance with the survey design requires that all people involved in conduct of the survey have the same understanding of how the respective tasks should be performed. This reference document will be important for supporting evaluations of possible procedural improvements.
- 19.3 **Initiated Actions:** A reference document that describes all of the standard operating procedures for the LPIS is currently being developed.
- 19.4 **Recommended Actions:** Descriptions of standard operating procedures should be updated as changes in survey methodology are made. Descriptions of standard procedures and protocols that appear in the various documents supporting the performance of the survey should always be modified to match the standard reference.

MRFSS Coastal Household Telephone Survey (CHTS):

- 1. **Potential Bias Due to Estimation Error:** Because the higher probability of contact with multiple-line households is not taken into account in the MRFSS CHTS estimation equations, an estimation bias could occur if there is a consistent correlation between the number of lines and the mean number of saltwater fishing trips per household.
 - 1.1. **Background:** Households with more than one landline telephone number have a higher probability of being selected by the random-digit-dialing sampling approach. The MRFSS CHTS has not traditionally collected data to identify multiple-line households and determine the numbers of lines in such households.
 - 1.2. **Assessment:** A question must be added to CHTS interview to ask each initial respondent for the number of landline phone numbers in the household. In 2001, a question was added to identify the number of landline phones in each household that reported fishing trips (“fishing households”). The question would also have to be asked for at least a systematic subsample of the non-fishing households contacted in order to get the data needed to appropriately weight household data relative to the sampling probability and assure unbiased estimates of mean fishing effort.
 - 1.3. **Completed Actions:** Changes in CHTS questionnaires have already been made in preparation for the collection of 2007 data on the number of landline phones in each contacted household. Questions will be asked for all contacted fishing households and for a random subsample of contacted non-fishing households.
 - 1.4. **Recommended Actions:** The number of landline phones should be used to determine the sampling probability for each contacted household. That

probability should be used to weight data from each contacted household prior to calculation of mean trips per household so that comparisons can be made between revised and traditional estimates to see if there is any evidence of a possible bias.

2. **Potential Bias Due to Measurement Error:** Differing interviewing procedures for obtaining respondent reports of fishing trips made during the prior two months appear to make a significant difference in resulting estimates of mean respondent fishing effort.
 - 2.1. **Background:** The CHTS has traditionally asked respondents to identify the number of fishing trips they took during a prior 60-day period before proceeding to profile each trip one-by-one, starting with the most recent one. Respondents often end up profiling a different number of trips than they originally report. If they end up profiling more than they initially reported, the initial value is revised to match the number of trips profiled. However, if they profile fewer trips than they initially reported, the CHTS has traditionally used the initial report as the correct total. Recent license-based, angler directory surveys conducted in California, Oregon, and Washington have used a different approach, revising the trip total to match the number of trips profiled if that is the lower number. An ongoing study by the Pacific RecFIN Statistics Subcommittee has shown that the approach used can have a substantial impact on the magnitude of the survey estimates of fishing effort.
 - 2.2. **Assessment:** More study is needed to determine the most appropriate way to adjust initial responses relative to the number of trips profiled. It is possible that some respondents who report a high initial number of trips later decide to “bail out” of the interview by stopping short of profiling all trips and reporting that they didn’t take any more. If that were the case, then the initially reported higher number may be more accurate. It is also possible that some adjustment (upward or downward) of the initially reported number is needed in many cases to get more accurate recall of the trips made.
 - 2.3. **Initiated Actions:** The CHTS started collecting data several years ago to allow use of either of the two approaches, and an ongoing ST1 study is comparing estimates based on either “initial” or “revised end-of-interview” responses. The preliminary results suggest that the use of the latter approach can significantly reduce estimates of mean number of fishing trips per angler.
 - 2.4. **Recommended Actions:** More thorough analyses should be designed and conducted to evaluate the relative accuracies of “initial” and “revised end-of-interview” responses.
3. **Potential Gain in Coverage, Statistical Precision, and Spatial Resolution** – If data are collected on both in-state and out-of-state fishing trips, as well as the specific county location of each trip, stratified sampling of the full coastal zone RDD household frame can be used to produce effort estimates for individual county domains that can be aggregated to obtain traditional state level estimates that are statistically more precise.

- 3.1. **Background:** Prior to 1996, the CHTS only collected data on fishing trips taken in the respondent's state of residence. No information was collected on out-of-state fishing trips. The RDD household frame currently used for sampling in each state only includes households in the coastal counties of that state, and sampling is stratified by county. Only in-state trips by residents of each county are estimated by the CHTS. Such estimates are aggregated to get state level estimates of in-state trips by the coastal zone residents of that state. Starting in 1996, questions were added to the CHTS to obtain data on out-of-state trips, as well as data on the specific county location of each reported fishing trip.
- 3.2. **Assessment:** The collection of the out-of-state trip data allows one to produce estimates of fishing effort for each CHTS county stratum that are partitioned among all possible counties of fishing. Such county level effort estimates can be aggregated across CHTS county strata to produce estimates for spatial domains of varying sizes within or beyond the traditional coastal state boundaries. With this approach, it becomes possible to produce estimates of fishing effort at lower levels of spatial resolution than the traditional state level. Due to improved coverage and an increase in effective sample sizes, the resulting county level estimates can also be aggregated to get more complete and precise estimates of effort at the state level. Because the new estimates of effort are specific to counties of fishing, they can be matched with county level intercept survey estimates of mean catch per trip to get county level domain estimates of total catch by species. This allows the production of catch estimates at lower than state levels of resolution.
- 3.3. **Completed Actions:** ST1 has already developed and tested the necessary computer programs to perform this revised estimation approach. Comparisons of revised CHTS estimates with traditional ones have shown that this approach leads to significant gains in the precision of state level effort estimates. Because the new approach uses the entire coastal household frame for estimation of fishing effort in each state, the need for and magnitude of estimated intercept survey out-of-frame adjustment factors is greatly reduced. The new CHTS estimation programs have been used to produce effort estimates at lower than state levels of resolution that have proved useful in specialized analyses for specific fisheries.
- 3.4. **Recommended Actions:** The new CHTS estimation programs should be implemented as soon as possible to provide greater precision in state level estimates of effort and catch, as well as to provide greater flexibility in the level of spatial resolution employed for effort and catch estimates.
4. **Potential Gain in Sampling Efficiency – Longitudinal Sampling:** Because the traditional CHTS is based on a random-digit-dialing (RDD) sampling design that is relatively inefficient for making successful contacts with marine recreational fishing households, repeated measures of fishing effort in previously identified "fishing" households could significantly enhance overall survey efficiency.
 - 4.1. **Background:** A longitudinal panel survey of known fishing households could be used to supplement the traditional CHTS sampling based on random digit dialing. The NRC recommended this approach in a 2000 report. ST1 developed

a pilot study to test two alternative approaches for conducting a longitudinal panel survey of known fishing households in New Jersey. This pilot study was initiated in 2005 with some funding support from ACCSP, and is being continued through 2006. One longitudinal approach is based on repeated contacts over successive two-month waves, and the other is based on repeated contacts over successive years for the same two-month period. In both designs, overlapping panels of fishing households are obtained through the traditional RDD sampling of the CHTS. Each panel is retained for two successive contacts, and a new panel is started each sampling wave such that only two independent panels are being contacted in any one wave for each longitudinal approach.

- 4.2. **Assessment:** The data collected from the panel survey approach can be used to generate independent estimates of mean fishing effort by fishing households that can then be combined with the traditional CHTS estimates for fishing households to get estimates that would potentially be much more precise. The two panel survey designs both require different estimation methods than those used for the traditional CHTS. The repeated measures design is advantageous for testing the significance of temporal changes in mean fishing effort. The alternative wave-by-wave and year-by-year panel designs can be compared to determine which is more effective in helping to get more precise estimates of fishing effort by wave and/or by year.
- 4.3. **Completed Actions:** Preliminary analyses of results obtained from the first year of the pilot study have been conducted. Alternative combined estimators that would use both panel survey estimates and traditional CHTS estimates are being developed to support comparative evaluations.
- 4.4. **Recommended Actions:** More thorough analyses of the pilot study results should be performed. Alternative combined estimators should be evaluated.

5. Potential Gains in Temporal Resolution: If the periodicity of the CHTS was changed from the current bimonthly schedule to a monthly (or more frequent) schedule, greater temporal resolution of fishing effort estimates could be obtained.

- 5.1. **Background:** Initial evaluations of different possible recall periods for the CHTS determined that a bimonthly stratification would best balance the trade-offs between cost-effectiveness and accuracy of recall. Shorter recall periods are likely to reduce possible memory errors, but the total number of telephone interviews needed to get the same amount of data would almost double with a change to a monthly stratification. In the current bimonthly survey, each respondent provides data on the number of fishing trips taken over the previous 60 days. In a monthly survey, each respondent would normally be asked to provide data on trips taken over the previous 30 days. The latter survey collects half as much data from each respondent; hence, twice as many interviews would be needed over the course of the year to get the same amount of data as is collected with the current bimonthly approach.
- 5.2. **Assessment:** In order to get greater temporal resolution in CHTS effort estimates, it will be necessary to consider changing the periodicity, or stratification, of the survey from bimonthly to monthly. If sufficient funding can be obtained to support the level of sampling required to get estimates at the

current level of precision, this change could support the estimation of more accurate and precise catch estimates at the current bimonthly level of temporal resolution, and it could also support more timely estimates at a monthly level.

- 5.3. **Recommended Actions:** A pilot study should be designed to test a monthly CHTS and compare resulting statistics with those generated by the current bimonthly stratification. It should be possible to continue to collect fishing effort data for a two-month period, as long as trips are clearly separated by month, and produce alternative estimates for the same month that would be based on different recall periods (one-month or two-month). This would allow evaluation of possible errors that may be attributable to the differences in the recall period.

6. **Potential Bias Due to Non-Response Error:** If the household residents who are more difficult to contact by phone or less likely to cooperate with telephone interviews are more, or less, likely to take fishing trips, then non-contacts and refusals could cause CHTS estimates of mean fishing effort per household to be biased.

- 6.1. **Background:** Although refusal rates for the CHTS are usually not very high, attempts to contact randomly selected telephone numbers frequently result in non-contacts, even after a minimum of five call-back attempts (spread through different times of the day and days of the week) have been made. Although the contact and refusal rates for the CHTS have been reported by the contractors and monitored by ST1 staff through the years, no attempt has been made to try to evaluate the possibility that non-respondent households significantly differ from respondent households in mean recreational fishing effort.

- 6.2. **Assessment:** Surveys to evaluate possible non-response errors generally use a contact method that is more likely to succeed than the base survey contact method. For example, non-response errors in mail surveys are usually evaluated by conducting a telephone survey of non-respondents. An effective survey of telephone survey non-respondents may require a door-to-door approach that would be extremely expensive. However, a less costly approach to evaluating potential for non-response errors would look at the data collected for successful contacts to see if the households requiring more contact attempts tend to report more, or fewer, fishing trips. If the number of contact attempts is correlated with the number of trips reported by household residents, this would suggest that non-respondent households were significantly different from respondent households.

- 6.3. **Recommended Actions:** Possible approaches to obtaining direct measures of potential CHTS non-response errors should be explored. Although data on dialing attempts for individual contacted households has not traditionally been included in data deliverables provided by contractors for the CHTS, such data is retained by the current contractor and would be available for analysis. Such data should be merged with the delivered CHTS data by household and analyzed to see if there is any significant correlation between contact attempts and the number of recreational trips reported for each mode of fishing. Non-contact rates reported in deliverable “wave reports” for the CHTS are currently being reviewed to assess the prevalence of different types of non-response.

7. **Potential Gains Due to Reduction of Sample Implementation Errors:** Many potential sample implementation errors can be prevented through improved training and supervision of survey staff and through improved monitoring of survey staff performance.
 - 7.1. **Background:** Procedures are already in place for effective training and supervision of telephone survey personnel to assure proper implementation of CHTS sampling protocols. Procedures are also in place for ST1 monitoring of the implementation of CHTS sampling protocols by contractor personnel. However, contractor data files with information on all randomly selected telephone numbers and their dialing histories, including results of all dialing attempts, are not currently required deliverables. Such files could be used for comparative analyses to determine when deviations from sampling protocols may have occurred. It is not currently easy to detect the dialing attempt histories for all telephone numbers selected as part of the RDD sample.
 - 7.2. **Assessment:** NRC questioned whether current monitoring of interviewer performance of sampling protocols was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 7.3. **Initiated Actions:** Current methods for monitoring adherence to CHTS sampling protocols are being reviewed.
 - 7.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by telephone interviewer supervisors, contractors, grantees, and ST1 staff. New standards should be set for when collected data will be considered unacceptable due to failed adherence to standard sampling protocols. Corrective actions should also be developed that will enhance the training and supervision of survey staff in ways that will increase adherence to the sampling protocols.
8. **Potential Gains Due to Reduction of Measurement Errors:** Many possible measurement errors can be prevented through improved training and supervision of telephone survey staff and through improved monitoring of survey staff performance.
 - 8.1. **Background:** Procedures are already in place for effective training and supervision of CHTS personnel to assure proper interviewing and recording procedures are followed. Procedures are also in place for quality control of telephone interviewing procedures by supervisors and quality control of fishing effort data recorded and entered through Computer Assisted Telephone Interviewing (CATI) procedures. A significant amount of monitoring of the data collection process is already practiced by contractor personnel. Interviewer supervisors are required to silently monitor and validate at least 10% of all interviews collected by each interviewer.
 - 8.2. **Assessment:** NRC questioned whether current monitoring of interviewer performance of interviewing procedures was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 8.3. **Initiated Actions:** Current methods for monitoring adherence to interviewing protocols are being reviewed. Specific attention is being paid to finding ways to

determine and document when errors may have occurred in the phrasing of questions or interpretation of responses by interviewers.

- 8.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by contractors and ST1 staff. Some silent monitoring of interviews by ST1 staff may be needed on a more regular basis. Corrective actions should be developed that will enhance the training and supervision of survey staff in ways that will increase their adherence to the standard CHTS protocols.

- 9. **Potential Gains Due to Reduction of Processing Errors:** Many possible data processing errors can be prevented through improved training and supervision of CHTS data processing staff and through improved monitoring of the performance of pre-estimation tasks such as data coding, data entry, data editing, and imputation.
 - 9.1. **Background:** Procedures are already in place for effective training and supervision of CHTS data processing personnel to assure that errors are prevented. Procedures are also in place for quality control of processing tasks by interviewers, data entry staff, data editing staff, and ST1 staff. A significant amount of monitoring of processing tasks is already practiced by contractor and grantee personnel, as well as ST1 staff. Data entry programs have been designed to prevent key entry errors and flag possible coding errors. Flagged records are checked by highly trained data auditing personnel who follow specific instructions to contact field staff and determine appropriate corrections for obvious coding errors. Records of all changes made to data during the editing process are provided as survey deliverables, and these records are routinely checked by ST1 staff.
 - 9.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 9.3. **Initiated Actions:** Current methods for monitoring adherence to data processing protocols are being reviewed.
 - 9.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by contractors, grantees, and ST1 staff.
- 10. **Potential Gains Due to Reduction of Estimation Errors:** Possible errors in the implementation of estimation procedures can be prevented through improved monitoring of the performance of programmers involved in developing, updating, and maintaining the SAS programs used to produce survey point estimates, variance estimates, and confidence intervals.
 - 10.1. **Background:** Procedures are already in place for effective training and supervision of SAS programmers for the surveys to assure that programming errors are prevented. Some procedures are also in place for the quality control of programming tasks by ST1 staff. However, new programs developed by one programmer for new estimation tasks have not always been reviewed by other programmers to check for possible problems.

- 10.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 10.3. **Initiated Actions:** Current methods for reviewing and validating the performance of new or modified SAS programs are being reviewed.
 - 10.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard quality assurance methods to be used by ST1 staff.
11. **Improved Documentation of Survey Protocols:** In order to better understand possible problems with current survey protocols, updated documentation of those protocols into one standard reference is needed.
- 11.1. **Background:** The descriptions of standard procedures for conduct of CHTS survey operations is currently scattered among a number of different documents, including technical reports, contract statements of work, and survey training manuals. Descriptions of some tasks vary to some extent among the different documents.
 - 11.2. **Assessment:** There is a need to develop one standard reference that describes all of the standard survey operations. This is important because consistent performance of sample selection, data collection, data processing, and statistical estimation tasks in accordance with the survey design requires that all people involved in conduct of the survey have the same understanding of how the respective tasks should be performed. This reference document will be important for supporting evaluations of possible procedural improvements.
 - 11.3. **Initiated Actions:** Development of a reference document that describes all of the standard operating procedures for the CHTS has been initiated.
 - 11.4. **Recommended Actions:** Descriptions of standard operating procedures should be updated as changes in survey methodology are made. Descriptions of standard procedures and protocols that appear in the various documents supporting the performance of the survey should always be modified to match the standard reference.

Angler Directory Telephone Surveys

- 1. **Potential Bias Due to Coverage Error:** The Pacific RecFIN angler license directory telephone surveys (ALDTS) being conducted by California and Washington are based on directory sampling frames developed from angler license lists that are not complete and do not include anglers who fished without a license. The exclusion of unlicensed anglers and some anglers with daily licenses could result in an estimation bias if those anglers fish at different rates than the anglers who are included in the survey frame.
- 1.1. **Background:** Although the intercept surveys in California and Washington collect data on license status of intercepted anglers, no data is collected on the fishing effort of unlicensed anglers or anglers with daily licenses who did not get included in the ALDTS list frame. Therefore, it is difficult to determine the mean effort of any anglers missed by the ALDTS. If both the number of anglers

missed and the mean effort of such anglers were known, then any estimation bias resulting from their exclusion by the ALDTS could potentially be corrected.

- 1.2. **Assessment:** The CHTS is being continued in CA and WA to allow comparisons with the ALDTS. Questions can be added to that survey to obtain data on the license status of anglers who report fishing trips. This could allow an independent assessment of the mean numbers of trips by unlicensed anglers or anglers licensed in categories excluded from the ALDTS frame.
- 1.3. **Initiated Actions:** New CHTS questionnaires are being developed that will include questions on license status.
- 1.4. **Recommended Actions:** Estimation methods should be added to obtain point and variance estimates of the mean fishing rates of anglers in different license status categories, as well as the proportions of total trips made by anglers in the different categories.

2. Potential Gain in Coverage and Sampling Efficiency - Dual Frame Survey: The coverage and statistical precision of telephone surveys of marine recreational fishing on private/rental boats, natural shorelines, or man-made shore structures can potentially be improved if a “dual frame” survey design could be employed that would combine sampling of angler list frames based on recreational fishing licenses with sampling of household frames.

- 2.1. **Background:** ST1 recognized that data collected through sampling of licensed angler list frames could be used in conjunction with CHTS data to provide “dual frame” survey estimates of marine recreational fishing effort. The Gulf States Marine Fisheries Commission (GSMFC) indicated a willingness to coordinate with ST1 to lead the development of a dual frame pilot study to test the new approach. Telephone survey data obtained from a directory frame of state-licensed anglers (“angler list frame”) will be used in conjunction with sample data collected from the random-digit-dialing frame of coastal zone households (“household frame”) to create dual frame estimates of fishing effort that are more comprehensive and more accurate than “single frame estimates” based on either individual frame.
- 2.2. **Assessment:** The States of Florida, Alabama, Mississippi, and Louisiana all have some form of recreational fishing license program that provides data which could be used to compile angler telephone directory frames. Random sampling of such frames should be a more efficient approach for obtaining data on marine recreational fishing than the current random-digit-dialing approach used by the CHTS. An Angler License Directory Telephone Survey (ALDTS) approach using the available angler list frames could be used in conjunction with the traditional CHTS approach to provide dual frame survey estimates that should be more accurate and precise than those generated alone by either survey approach. As long as the questionnaires for the ALDTS and CHTS interviews are matched up to record the information needed to identify the interviewed anglers covered included in both frame, it will be possible to avoid overlaps and produce CHTS and ALDTS estimates of fishing effort by mode that can be added to get accurate totals.

- 2.3. **Completed Actions:** ST1 has already coordinated with GSMFC staff and staff from the state agencies of FL, AL, MS, and LA to plan a pilot study to test this dual frame (ALDTS/CHTS) approach for the estimation of fishing effort statistics in the Gulf of Mexico. ST1 has led the development of a Statement of Work for the pilot study and has added it as an option in the Request for Proposals issued for the ongoing procurement of contractor services for the 2007-2009 MRFSS CHTS. The contract should be awarded before the end of December 2006, and the pilot study is planned to start in 2007. Questionnaires have been designed to ensure that all information needed for the dual frame estimates will be obtained.
 - 2.4. **Initiated Actions:** State partners are preparing their angler license directories to meet standard design criteria established through the collaborative planning process. The dual frame estimation methods are currently being developed.
 - 2.5. **Recommended Actions:** The angler list frames should be updated every two months to support the bimonthly ALDTS sampling efforts. Statistical estimates from the dual frame design should be compared with those generated separately by the CHTS and ALDTS to evaluate the gains in efficiency, accuracy, and precision obtained with the dual frame approach.
3. **Potential Bias Due to Non-Response Error:** If the anglers who are more difficult to contact by phone or less likely to cooperate with telephone interviews are more, or less, likely to take fishing trips, then non-contacts and refusals could cause ALDTS estimates of mean fishing effort per angler to be biased.
 - 3.1. **Background:** Although refusal rates for the ALDTS are usually not very high, attempts to contact randomly selected license holders frequently result in non-contacts, even after a minimum of five call-back attempts (spread through different times of the day and days of the week) have been made. Although the contact and refusal rates for the ALDTS have been reported by the contractors, no attempt has been made to monitor those rates or try to evaluate the possibility that non-respondent anglers significantly differ from respondent anglers in mean recreational fishing effort.
 - 3.2. **Assessment:** Surveys to evaluate possible non-response errors generally use a contact method that is more likely to succeed than the base survey contact method. For example, non-response errors in mail surveys are usually evaluated by conducting a telephone survey of non-respondents. An effective survey of telephone survey non-respondents may require a door-to-door approach that would be extremely expensive. However, a less costly approach to evaluating potential for non-response errors would look at the data collected for successful contacts to see if the anglers requiring more contact attempts tend to report more, or fewer, fishing trips. If the number of contact attempts is correlated with the number of trips reported by contacted license holders, this would suggest that non-respondent anglers were significantly different from respondent anglers.
 - 3.3. **Recommended Actions:** Possible approaches to obtaining direct measures of potential ALDTS non-response errors should be explored. Although data on dialing attempts for individual contacted anglers has not traditionally been included in data deliverables provided by contractors for the ALDTS, such data

is retained by the current contractor and would be available for analysis. Such data should be merged with the delivered ALDTS data by angler and analyzed to see if there is any significant correlation between contact attempts and the number of recreational trips reported for each mode of fishing. Non-contact rates reported in deliverable “wave reports” for the ALDTS should be reviewed to assess the prevalence of different types of non-response.

4. **Potential Gains Due to Reduction of Sample Implementation Errors:** Many potential sample implementation errors can be prevented through improved training and supervision of survey staff and through improved monitoring of survey staff performance.
 - 4.1. **Background:** Procedures are already in place for effective training and supervision of telephone survey personnel to assure proper implementation of ALDTS sampling protocols in each state. Procedures are also in place for Pacific RecFIN monitoring of the implementation of ALDTS sampling protocols by contractor personnel. However, contractor data files with information on all randomly selected anglers and their dialing histories, including results of all dialing attempts, are not currently required deliverables. Such files could be used for comparative analyses to determine when deviations from sampling protocols may have occurred. It is not currently easy to detect the dialing attempt histories for all anglers selected as part of the ALDTS sample.
 - 4.2. **Assessment:** NRC questioned whether current monitoring of interviewer performance of sampling protocols was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 4.3. **Initiated Actions:** Current methods for monitoring adherence to ALDTS sampling protocols are being reviewed by RecFIN partners.
 - 4.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by telephone interviewer supervisors, contractors, grantees, and RecFIN/State/NMFS staff. New standards should be set for when collected data will be considered unacceptable due to failed adherence to standard sampling protocols. Corrective actions should also be developed that will enhance the training and supervision of survey staff in ways that will increase adherence to the sampling protocols.
5. **Potential Gains Due to Reduction of Measurement Errors:** Many possible measurement errors can be prevented through improved training and supervision of telephone survey staff and through improved monitoring of survey staff performance.
 - 5.1. **Background:** Procedures are already in place for effective training and supervision of ALDTS personnel to assure proper interviewing and recording procedures are followed. Procedures are also in place for quality control of telephone interviewing procedures by supervisors and quality control of fishing effort data recorded and entered through Computer Assisted Telephone Interviewing (CATI) or manual procedures. A significant amount of monitoring of the data collection process is already practiced by contractor personnel.

Interviewer supervisors are required to silently monitor and validate at least 10% of all interviews collected by each interviewer.

- 5.2. **Assessment:** NRC questioned whether current monitoring of interviewer performance of interviewing procedures was sufficient. Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 5.3. **Initiated Actions:** Current methods for monitoring adherence to interviewing protocols are being reviewed by RecFIN partners. Specific attention is being paid to finding ways to determine and document when errors may have occurred in the phrasing of questions or interpretation of responses by interviewers.
 - 5.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by contractors and RecFIN/State/NMFS staff. Some silent monitoring of interviews by RecFIN/State/NMFS staff may be needed on a more regular basis. Corrective actions should be developed that will enhance the training and supervision of survey staff in ways that will increase their adherence to the standard ALDTS protocols in each State.
6. **Potential Gains Due to Reduction of Processing Errors:** Many possible data processing errors can be prevented through improved training and supervision of ALDTS data processing staff and through improved monitoring of the performance of pre-estimation tasks such as data coding, data entry, data editing, and imputation.
- 6.1. **Background:** Procedures are already in place for effective training and supervision of ALDTS data processing personnel to assure that errors are prevented. Procedures are also in place for quality control of processing tasks by interviewers, data entry staff, data editing staff, and RecFIN/State/NMFS staff. A significant amount of monitoring of processing tasks is already practiced by contractor and grantee personnel, as well as RecFIN/State/NMFS staff. Data entry programs have been designed to prevent key entry errors and flag possible coding errors. Flagged records are checked by highly trained data auditing personnel who follow specific instructions to determine appropriate corrections, when possible, for obvious coding errors. Records of all changes made to data during the editing process are not currently provided as survey deliverables that can be checked by RecFIN/State/NMFS staff.
 - 6.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 6.3. **Initiated Actions:** Current methods for monitoring adherence to data processing protocols are being reviewed.
 - 6.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard monitoring methods to be used by contractors, grantees, and RecFIN/State/NMFS staff.
7. **Potential Gains Due to Reduction of Estimation Errors:** Possible errors in the implementation of estimation procedures can be prevented through improved monitoring of the performance of programmers involved in developing, updating, and

maintaining the SAS programs used to produce survey point estimates, variance estimates, and confidence intervals.

- 7.1. **Background:** Procedures are already in place for effective training and supervision of SAS programmers for the surveys to assure that programming errors are prevented. Some procedures are also in place for the quality control of programming tasks by ST1 staff. However, new programs developed by one programmer for new estimation tasks have not always been reviewed by other programmers to check for possible problems.
 - 7.2. **Assessment:** Although monitoring mechanisms are in place, the level of effort devoted to monitoring tasks may need to be elevated and more rigorous minimum standards may need to be set.
 - 7.3. **Initiated Actions:** Current methods for reviewing and validating the performance of new or modified SAS programs are being reviewed.
 - 7.4. **Recommended Actions:** Recommendations should be developed for more rigorous standard quality assurance methods to be used by RecFIN/State/NMFS staff.
8. **Improved Documentation of Survey Protocols:** In order to better understand possible problems with current survey protocols, updated documentation of those protocols into one standard reference is needed.
- 8.1. **Background:** The descriptions of standard procedures for conduct of the ALDTS operations in each State is currently scattered among a number of different documents, including technical reports, contract statements of work, and survey training manuals. Descriptions of some tasks vary to some extent among the different documents.
 - 8.2. **Assessment:** There is a need to develop one standard reference for each State that describes all of the standard survey operations. This is important because consistent performance of sample selection, data collection, data processing, and statistical estimation tasks in accordance with the survey design requires that all people involved in conduct of the survey have the same understanding of how the respective tasks should be performed. This reference document will be important for supporting evaluations of possible procedural improvements.
 - 8.3. **Initiated Actions:** A reference document that describes all of the standard operating procedures for the intercept surveys in each region is currently being developed.
 - 8.4. **Recommended Action:** Descriptions of standard operating procedures should be updated as changes in survey methodology are made. Descriptions of standard procedures and protocols that appear in the various documents supporting the performance of the survey should always be modified to match the standard reference.

FHS – Vessel Directory Telephone Survey

1. **Potential Gains in Coverage and Sampling Efficiency – Dual Frame Survey:** The coverage and statistical precision of surveys of for-hire boats can potentially be

improved if a “dual frame” survey design could be employed to appropriately combine data collected through existing mandatory census surveys of federally permitted boats with data obtained by sampling surveys (like the For-Hire Survey) that cover more complete list frames of boats.

- 1.1. **Background:** ST1 recognized that Northeast Vessel Trip Reports (VTR) data could be used in conjunction with FHS telephone survey data to provide “dual frame” survey estimates of marine recreational fishing effort on Northeast region charter boats and headboats. Census data obtained from a frame of vessels with Federal permits (“censused VTR frame”) was used in conjunction with sample data collected from a larger, overlapping frame (“sampled FHS frame”) of known for-hire vessels (that includes vessels fishing without Federal permits) to create dual frame estimates of fishing effort that are more comprehensive and more accurate than “single frame estimates” based on either individual frame.
- 1.2. **Assessment:** The NRC Report encouraged use of dual frame surveys in cases where available list frames are known to be incomplete. We recognize that a similar approach could be used to integrate Southeast Headboat Survey (SEHS) census data with FHS sample data into dual frame estimates of marine recreational fishing effort on headboats in the Southeastern states. In addition, this new approach can also be used to generate revised estimates of HMS fishing effort and catch that are based on a similar combination of VTR data and HMS data collected for the permitted HMS vessels covered by the FHS.
- 1.3. **Completed Actions:** A draft report on this dual VTR/FHS vessel frame method has been prepared and is currently under review by the NER staff responsible for the VTR Program. ST1 plans to submit the revised report for an external review prior to submitting it for publication in an appropriate journal.
- 1.4. **Recommended Actions:** Testing and evaluation of a similar dual frame approach for combining FHS data with SEHS census data should be conducted. In addition, testing and evaluation of a VTR/FHS dual frame approach for LPS for-hire estimates should be explored.

2. **Potential Gains Due to Improved Coverage:** Potential FHS coverage errors would be greatly reduced by implementing improved procedures for assuring timely updating of vessel directory frames from various sources and for cross-checking data from different sources to avoid duplicate entries and maximize the completeness and quality of information entered for individual vessels.
 - 2.1. **Background:** The vessel database for the FHS is compiled from multiple sources, including state vessel registration lists, NMFS permit lists, and intercept survey contacts. The availability and quality of updated lists typically varies among sources. Accurate, up-to-date information is needed on the telephone numbers and addresses of vessel owners and operators, as well as on the identifying numbers and characteristics of the vessels.
 - 2.2. **Assessment:** More frequent updates from all vessel directory sources are needed to support more complete and efficient coverage of the for-hire vessels participating in the fishery. Standardized methods for cross-checking of data from different sources are needed to prevent duplication of vessels and to ensure

- that the most up-to-date, accurate information on vessel owners and operators is entered in the directory frame to be used for the telephone survey sampling.
- 2.3. **Initiated Actions:** ST1 is already evaluating current procedures for vessel frame development, update, and maintenance to determine appropriate tasks to be added to improve the process.
 - 2.4. **Recommended Actions:** Further work is needed to establish a standardized and documented sequence of tasks which will assure that frame quality control objectives are met on a consistent basis.
3. **Potential Bias Due to Non-Response Error:** If the vessel operators who are more difficult to contact by phone or less likely to cooperate with telephone interviews are more, or less, likely to take fishing trips, then non-contacts and refusals could cause FHS estimates of mean fishing effort per vessel to be biased.
 - 3.1. **Background:** Although refusal rates for the FHS are usually not very high, attempts to contact randomly selected vessel operators frequently result in non-contacts, even after up to 10 call-back attempts (spread through different times of the day and days of the week) have been made. Although the contact and refusal rates for the FHS have been reported by the contractors and monitored by ST1 staff, only a couple of attempts have been made to evaluate the possibility that vessels operated by non-respondents significantly differ from vessels operated by respondents in mean for-hire fishing effort. The 1998-1999 pilot study for the FHS in the Gulf of Mexico included a follow-up telephone survey of non – respondents that did not show a significant difference between initial respondents and non-respondents in mean reported vessel trips. However, the 2001 pilot study that compared the FHS with a mandatory logbook reporting program in South Carolina included a comparison of logbook reports for FHS respondents and non-respondents that showed non-respondents reported significantly more trips on the average than respondents did
 - 3.2. **Assessment:** Surveys to evaluate possible non-response errors generally use a contact method that is more likely to succeed than the base survey contact method. For example, non-response errors in mail surveys are usually evaluated by conducting a telephone survey of non-respondents. An effective assessment of non-response errors can be performed for certain subsets of FHS telephone survey non-respondents using census data already provided in response to ongoing logbook programs, such as the mandatory Northeast VTR program for federally permitted vessels or the mandatory Southeast Headboat Survey program. Matching of data FHS and census data can identify censused vessels that were included in the FHS sample. Comparisons of census data on fishing effort can be made between “respondent” and “non-respondent” vessels in the FHS sample to see if measures of mean effort are significantly different. Other less costly approaches for evaluating potential for non-response errors would include follow-up telephone surveys like the one conducted in the Gulf or analyses that compare data provided by “easy to contact” and “hard to contact” respondents. One can look at the data collected for successful contacts to see if the vessel operators requiring more contact attempts tend to report more, or fewer, fishing trips. If the number of contact attempts is correlated with the

number of trips reported by contacted vessel operators, this would suggest that “non-respondent” vessels in the survey sample were significantly different from “respondent” vessels.

- 3.3. **Recommended Actions:** Other possible approaches to obtaining direct measures of potential FHS non-response errors should be explored. Comparisons of census data on fishing effort should be made between “respondent” and “non-respondent” federally permitted vessels in the FHS sample to see if there is any evidence for significant FHS non-response errors. Data on dialing attempts for individual contacted vessel operators are included in data deliverables provided by the contractor or grantee conducting the survey and are available for analysis. These data should be analyzed to see if there is any significant correlation between contact attempts and the number of recreational trips reported. Non-contact rates have already been reviewed to assess the prevalence of different types of non-response.
4. **Improved Documentation of Survey Protocols:** In order to better understand possible problems with current survey protocols, updated documentation of those protocols into one standard reference is needed.
 - 4.1. **Background:** The descriptions of standard procedures for conduct of FHS operations is currently scattered among a number of different documents, including technical reports, contract statements of work, and survey training manuals. Descriptions of some tasks vary to some extent among the different documents.
 - 4.2. **Assessment:** There is a need to develop one standard reference that describes all of the standard survey operations for the FHS. This is important because consistent performance of sample selection, data collection, data processing, and statistical estimation tasks in accordance with the survey design requires that all people involved in conduct of the survey have the same understanding of how the respective tasks should be performed. These reference documents will be important for supporting evaluations of possible procedural improvements.
 - 4.3. **Initiated Actions:** Reference documents that describe all of the standard operating procedures for the FHS are being developed.
 - 4.4. **Recommended Actions:** Descriptions of standard operating procedures should be updated as changes in survey methodology are made. Descriptions of standard procedures and protocols that appear in the various documents supporting the performance of the survey should always be modified to match the standard reference.

LPS – Private Boat Directory Telephone Survey

1. **Potential Bias Due to Non-Response Error:** If the operators of HMS private boats who are more difficult to contact by phone or less likely to cooperate with telephone interviews are more, or less, likely to take fishing trips, then non-contacts and refusals could cause LPTS estimates of mean fishing effort per vessel to be biased.
 - 1.1. **Background:** Although refusal rates for the LPTS are usually not very high, attempts to contact randomly selected permit holders may result in non-contacts,

even after up to 10 call-back attempts (spread through different times of the day and days of the week) have been made. Although the contact and refusal rates for the LPTS have been reported by the contractor, no attempt has been made to monitor those rates or try to evaluate the possibility that the vessel operated by non-respondents differ in mean fishing effort from the vessels operated by respondents.

- 1.2. **Assessment:** Surveys to evaluate possible non-response errors generally use a contact method that is more likely to succeed than the base survey contact method. For example, non-response errors in mail surveys are usually evaluated by conducting a telephone survey of non-respondents. An effective survey of telephone survey non-respondents may require a dockside survey approach that could be rather expensive. However, a less costly approach to evaluating potential for non-response errors would look at the data collected for successful contacts to see if the vessel operators requiring more contact attempts tend to report more, or fewer, fishing trips. If the number of contact attempts is correlated with the number of trips reported, this would suggest that “non-respondent” vessels were significantly different from “respondent” vessels.
- 1.3. **Recommended Actions:** Possible approaches to obtaining direct measures of potential LPTS non-response errors should be explored. Data on dialing attempts for individual contacted vessel operators have been included in data deliverables provided by the contractor for the LPTS and are available for analysis. These data should be analyzed to see if there is any significant correlation between contact attempts and the number of recreational trips reported for each mode of fishing. Non-contact rates reported in deliverable “wave reports” for the LPTS have already been reviewed to assess the prevalence of different types of non-response.

2. **Potential Gains Due to Improved Coverage:** Potential LPTS coverage errors would be greatly reduced by implementing improved procedures for assuring timely updating of the HMS private vessel directory frame from the HMS Angling Category and Bluefin Tuna General Category permit databases and for cross-checking data from different sources to avoid duplicate entries and maximize the completeness and quality of information entered for individual vessels.

- 2.1. **Background:** The vessel database for the LPTS is compiled from the NMFS permit lists. The availability and quality of updated lists typically varies between sources. Accurate, up-to-date information is needed on the telephone numbers and addresses of vessel owners and operators, as well as on the identifying numbers and characteristics of the vessels.
- 2.2. **Assessment:** More frequent updates from all vessel directory sources are needed to support more complete and efficient coverage of the private vessels participating in the HMS fishery. Standardized methods for cross-checking of data from the two different source lists are needed to prevent duplication of vessels and to ensure that the most up-to-date, accurate information on vessel owners and operators is entered in the directory frame to be used for the telephone survey sampling.

- 2.3. **Initiated Actions:** ST1 is already evaluating current procedures for vessel frame development, update, and maintenance to determine appropriate tasks to be added to improve the process.
 - 2.4. **Recommended Actions:** Further work is needed to establish a standardized and documented sequence of tasks which will assure that frame quality control objectives are met on a consistent basis.
3. **Improved Documentation of Survey Protocols:** In order to better understand possible problems with current survey protocols, updated documentation of those protocols into one standard reference is needed.
- 3.1. **Background:** The descriptions of standard procedures for conduct of the private boat LPTS operations is currently scattered among a number of different documents, including technical reports, contract statements of work, and survey training manuals. Descriptions of some tasks vary to some extent among the different documents.
 - 3.2. **Assessment:** There is a need to develop one standard reference that describes all of the standard survey operations for the LPTS. This is important because consistent performance of sample selection, data collection, data processing, and statistical estimation tasks in accordance with the survey design requires that all people involved in conduct of the survey have the same understanding of how the respective tasks should be performed. These reference documents will be important for supporting evaluations of possible procedural improvements.
 - 3.3. **Initiated Actions:** Reference documents that describe all of the standard operating procedures for the LPTS are being developed.
 - 3.4. **Recommended Actions:** Descriptions of standard operating procedures should be updated as changes in survey methodology are made. Descriptions of standard procedures and protocols that appear in the various documents supporting the performance of the survey should always be modified to match the standard reference.